

REMARKS

Applicants have carefully reviewed and considered the Office Action mailed on November 20, 2003, and the Advisory Action mailed February 25, 2004.

Independent claims 18, 21, 28, 34, 37, and 43 have been amended. No claims have been canceled or added. As a result, claims 18-25, 27, 28, 30-43, and 45-47 remain pending in this application.

Correction of Title

Applicants wish to point out that, in the present “Amendment and Response”, the correct title has been used in the initial caption appearing at the top of page 1 and in the page headers.

In the “Amendment and Response” filed on May 13, 2002, Applicants amended the title to “Via-In-Pad With Off-Center Geometry”.

However, in the “Amendment and Response” filed on February 4, 2003, Applicants inadvertently reverted to the original title “Via-In-Pad With Off-Center Geometry And Methods of Manufacture” in the caption and headers.

Amendments to the Claims

As pointed out above, independent claims 18, 21, 28, 34, 37, and 43 have been amended by inserting the word “mounting” before “lands” (first occurrence). Support for this amendment may be found, for example, on page 2, lines 23-24.

In addition, in independent claim 18, the phrase “to mount corresponding contacts of an integrated circuit package” has been inserted after “lands” (first occurrence), and the phrase “and wherein each via comprises a via cap” has been inserted after “land” (third occurrence). Support for the first phrase may be found, for example, on page 2, lines 23-24, and support for the second phrase may be found, for example, on page 6, lines 3-4.

In addition, in independent claim 21, the word “hollow” has been inserted before “via” (first occurrence). Support may be found, for example, on page 6, lines 10-11.

No new matter has been added.

Rejection of Claims 18-21, 25, 27, 28, 30, 32-38, 42, 43 and 45-47
under 35 U.S.C. §103(a) as Unpatentable
over Sherman in View of Perfecto

Claims 18-21, 25, 27, 28, 30, 32-38, 42, 43 and 45-47 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sherman (U.S. 5,784,262) in view of Perfecto et al. (U.S. 5,464,682).

Sherman discloses an arrangement of pad-through-hole combinations (21A, FIG. 2A) on a substrate. Each pad-through-hole combination includes a mounting pad 18A connected to a via pad 26A through a narrow neck-like structure or trace 27A. FIG. 3 shows an arrangement of pad-through-hole combinations, in which groups of pad-through-hole combinations are oriented in different directions. In Sherman, the pad-through-hole combination has a dumb-bell shape.

Perfecto discloses a ceramic substrate (20, FIG. 2) having a circular “capture pad” 30. The capture pad 30 functions to connect a ceramic via 22 with a thin film stud contact portion 28. Perfecto apparently contains no disclosure concerning how a chip (16, FIG. 1) is connected to a substrate 20. Further, Perfecto apparently contains no disclosure as to a solder ball, or any other form of solder whatsoever, adhering to a respective one of the capture pads 30. For this reason, Perfecto does not disclose any “mounting land”, as is now recited in each of Applicants’ independent claims 18, 21, 28, 34, 37, and 43.

Applicants’ arguments asserting the patentability of various claim groups that are included in this ground of rejection appear immediately below. Rather than all of the claims being discussed in numerical order, dependent claims have been grouped with their respective independent claims for convenience and conciseness.

Claims 18-20 and 32-33

Regarding independent claim 18, the Examiner concedes that Sherman fails to explicitly teach that each land has a circular perimeter and that each solder ball is adhering to the entire respective land. The Examiner states that Perfecto teaches an offset circular land (reference number 30) that connects a via to another circuit layer. Applicants respectfully assert that Perfecto fails to show any “mounting land”. The term “land”, as used in Applicants’ disclosure, refers to a mounting or bonding pad used to couple an electrical contact of a component to a

trace on a substrate (please refer to page 2, lines 22-27, of the present application, for example). The component contact is coupled to a corresponding land with solder (refer to page 3, lines 4-10). To emphasize that the term “land”, as recited in Applicants’ independent claims 18, 21, 28, 34, 37, and 43, refers to a mounting or bonding pad, and that the term “land” does not refer to a “capture pad”, each of such independent claims has been amended to recite a plurality of “mounting lands”.

Perfecto contains no disclosure whatsoever that circular capture pad 30 (FIG. 2) is a “mounting land”. The function of capture pad 30 is to electrically connect a ceramic via 22 and a thin film stud 24 (refer to col. 1, lines 65-67 and to col. 3, lines 49-51, for example). Capture pad 30 electrically connects these two conductors via its own metallization, and no solder is used. No terminal is mounted upon capture pad 30 with solder. Applicants were unable to find any mention of the word “land” or the word “solder” within Perfecto. If the Examiner has determined otherwise, he is respectfully requested to point out the precise location within Perfecto.

Regarding independent claim 18, the Examiner stated that it would have been obvious to one of ordinary skill in the art to combine the teachings of Sherman and Perfecto in order to have the Sherman land having the same shape as the Perfecto land and inherently teaching that each solder ball will be adhering to the entire respective land. However, as asserted by Applicants above, Perfecto fails to disclose any “mounting land”, so it would have been impossible to combine the Sherman land with any teaching concerning a “mounting land” in Perfecto.

Independent claim 18 is directed to structure that is not disclosed in either Sherman or Perfecto, so a *prima facie* case of obviousness has not been established. For example, claim 18 recites *inter alia* a plurality of mounting lands each having a circular perimeter, and a plurality of solder balls, each solder ball adhering to a respective one of the lands, each solder ball adhering to the entire respective land. Neither Sherman nor Perfecto, whether taken individually or in the Examiner’s suggested combination, discloses this recited structure.

For the above reasons, claim 18 should be found to be allowable over any combination of Sherman or Perfecto, and Applicant respectfully requests that the rejection of claim 18 under 35 U.S.C. §103(a) as being unpatentable over Sherman in view of Perfecto should be withdrawn.

Claims 19-20 and 32-33, which depend directly or indirectly from claim 18 and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

Claims 21, 25, 27, 28, and 30

Regarding independent claims 21 and 28, the Examiner concedes that Sherman fails to explicitly teach that each of the solder balls is contacting substantially the entire respective land to the edge of the land. The Examiner stated that it would have been obvious to one of ordinary skill in the art to combine the teachings of Sherman and Perfecto in order to have the Sherman land having the same shape as the Perfecto land and inherently teaching that each solder ball will be adhering to the entire respective land. However, as asserted by Applicants above, Perfecto fails to disclose a “mounting land”, so it would have been impossible to combine the Sherman land with any teaching concerning a “mounting land” in Perfecto.

Applicants assert that a *prima facie* case of obviousness has not been established, because independent claims 21 and 28 are directed to structure that is not disclosed in either Sherman or Perfecto, and because there is no suggestion or motivation, either in the Sherman and Perfecto references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine them to arrive at the subject matter recited in independent claims 21 and 28.

For the above reasons, independent claims 21 and 28 should be found to be allowable over any combination of Sherman or Perfecto, and Applicants respectfully request that the rejection of claims 21 and 28 under 35 U.S.C. §103(a) as being unpatentable over Sherman in view of Perfecto should be withdrawn.

Claims 25 and 27, which depend from independent claim 21 and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

Claim 30, which depends from independent claim 28 and incorporates all of the limitations therein, is also asserted to be allowable for the reasons presented above.

Claims 34-36

Regarding independent claim 34, the Examiner concedes that Sherman fails to explicitly teach that each solder ball is adhering to the entire respective land. The Examiner stated that it

would have been obvious to one of ordinary skill in the art to combine the teachings of Sherman and Perfecto in order to have the Sherman land having the same shape as the Perfecto land and inherently teaching that each solder ball will be adhering to the entire respective land. However, as asserted by Applicants above, Perfecto fails to disclose a “mounting land”, so it would have been impossible to combine the Sherman land with any teaching concerning a “mounting land” in Perfecto.

Applicants assert that a *prima facie* case of obviousness has not been established, because independent claim 34 is directed to structure that is not disclosed in either Sherman or Perfecto, and because there is no suggestion or motivation, either in the Sherman and Perfecto references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine them to arrive at the subject matter recited in independent claim 34.

For the above reasons, independent claim 34 should be found to be allowable over any combination of Sherman or Perfecto, and Applicants respectfully request that the rejection of claim 34 under 35 U.S.C. §103(a) as being unpatentable over Sherman in view of Perfecto should be withdrawn.

Claims 35 and 36, which depend from independent claim 34, and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

Claims 37, 38, 42, 43, and 45-47

Regarding independent claims 37 and 43, the Examiner concedes that Sherman fails to explicitly teach that each land has a circular perimeter. The Examiner stated that it would have been obvious to one of ordinary skill in the art to combine the teachings of Sherman and Perfecto in order to have the Sherman land having the same shape as the Perfecto land and inherently teaching that each solder ball will be adhering to the entire respective land. However, as asserted by Applicants above, Perfecto fails to disclose a “mounting land”, so it would have been impossible to combine the Sherman land with any teaching concerning a “mounting land” in Perfecto.

Applicants assert that a *prima facie* case of obviousness has not been established, because independent claims 37 and 43 are directed to structure that is not disclosed in either Sherman or Perfecto, and because there is no suggestion or motivation, either in the Sherman and Perfecto

references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine them to arrive at the subject matter recited in independent claims 37 and 43.

For the above reasons, independent claims 37 and 43 should be found to be allowable over any combination of Sherman or Perfecto, and Applicants respectfully request that the rejection of claims 37 and 43 under 35 U.S.C. §103(a) as being unpatentable over Sherman in view of Perfecto should be withdrawn.

Claims 38, 42, and 46, which depend from independent claim 37 and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

Claims 45 and 47, which depend from independent claim 43 and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

Rejection of Claims 22-24 and 39-41
under 35 U.S.C. §103(a) as Unpatentable
over Sherman in View of Perfecto
and Further in View of Mehr

Claims 22-24 and 39-41 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sherman in view of Perfecto et al. and further in view of Mehr (U.S. 5,936,848).

Sherman and Perfecto were discussed earlier. Mehr discloses an electronics package that includes a substrate, a via, and a solder ball. As seen in FIG. 3 of the Mehr patent, solder mask material 38 partially enters into the via 32.

The Examiner concedes that his asserted combination of Sherman and Perfecto fails to explicitly teach that each via has a thermally expansive substance residing in the vias, but he stated that it would have been obvious to one of ordinary skill in the art to further modify the combination of Sherman and Perfecto with Mehr, in order to have a thermally expansive substance (i.e. solder mask material 38) residing in the vias.

Applicants' arguments asserting the patentability of claim groups 22-24 and 39-41 appear immediately below.

Claims 22-24

Claims 22-24 are dependent, directly or indirectly, from independent claim 21, which Applicants assert is patentable over the Examiner's suggested combination of Sherman and

Perfecto, as set forth earlier. The addition of Mehr to the Examiner's suggestion combination of Sherman and Perfecto would not substantively impact the patentability of independent claim 21.

Thus, claims 22-24, which depend directly or indirectly from claim 21 and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

Applicants respectfully request that the rejection of claims 22-24 under 35 U.S.C. §103(a) as unpatentable over Sherman in view of Perfecto and further in view of Mehr be withdrawn.

Claims 39-41

Claims 39-41 are dependent directly or indirectly from independent claim 37, which Applicants assert to be patentable over Sherman, as set forth earlier. The addition of Mehr to Sherman would not substantively impact the patentability of independent claim 37.

Thus, claims 39-41, which depend directly or indirectly from claim 37 and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

Applicants respectfully request that the rejection of claims 39-41 under 35 U.S.C. §103(a) as unpatentable over Sherman in view of Mehr be withdrawn.

Rejection of Claim 31 under 35 U.S.C. §103(a) as Unpatentable over Sherman in View of Perfecto and Further in View of Sakemi

Claim 31 was rejected under 35 U.S.C. §103(a) as being unpatentable over Sherman in view of Perfecto et al. and further in view of Sakemi et al. (U.S. 5,489,750).

The Examiner concedes that his asserted combination of Sherman and Perfecto fails to explicitly teach that each solder ball covers the perimeter of the land, but he stated that it would have been obvious to one of ordinary skill in the art to further modify the combination of Sherman and Perfecto with Sakemi, in order to have each solder ball covering the entire respective land, including the perimeter of the land.

Sherman and Perfecto were discussed earlier. Sakemi discloses a method of mounting an electronic part with bumps 4 of varying size on corresponding electrodes 21 of a circuit board

(FIGS. 11A-11C, described in col. 5, lines 29-52). Each electrode 21 has a hole 20 at a center thereof (col. 5, lines 2-3).

Claim 31 is dependent from independent claim 18, which Applicants assert to be patentable over the Examiner's suggested combination of Sherman and Perfecto, as set forth earlier. The addition of Sakemi to the Examiner's suggestion combination of Sherman and Perfecto would not substantively impact the patentability of independent claim 18.

Thus, claim 31, which depends from claim 18 and incorporates all of the limitations therein, is also asserted to be allowable for the reasons presented above.

Applicants respectfully request that the rejection of claims 31 under 35 U.S.C. §103(a) as unpatentable over Sherman in view of Perfecto and further in view of Sakemi be withdrawn.

Conclusion

Applicants respectfully submit that claims 18-25, 27, 28, 30-43, and 45-47 are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicants' attorney, Walter W. Nielsen (located in Phoenix, Arizona) at (602) 298-8920, or the below-signed attorney (located in Minneapolis, Minnesota) to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 22nd day of March, 2004.

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